1. Demographic Information

Background

The Ohio Transfer Module (OTM), Subgroup 2, Mathematics, Statistics, and Logic have been tasked with exploring the possibility of a discrete mathematics course specializing in the application of mathematics for students interested in computer science, information technology, and related fields. This effort is rooted in future exploration of Ohio Guaranteed Transfer Pathways (OGTP) computer science and information technology pathways.

Proposed Discrete Mathematics (TMM023) learning outcomes are based on college-level mathematics. TMM023 is recommended to introduces students to the logic and mathematical structures required in these fields of interest and serve the following purposes:

- Serves as a course that acquaints mathematical reasoning and several topics from discrete mathematics that underlie, inform, or elucidate the development, study, and practice of related fields.

- Act as a course integrating topics surrounding logic, proof techniques, set theory, functions and relations, counting and probability, elementary number theory, graphs and tree theory, base-*n* arithmetic, and Boolean algebra.

What We Need From You

Subgroup 2 seeks endorsement of the proposed learning outcomes for TMM023. Please review proposed learning outcomes and coordinate efforts within your institution to complete the endorsement survey to determine if your institution agrees or disagrees with proposed course learning outcomes. We are collecting only one response per institution.

Please provide your institutional response by **October 9, 2020**. The survey link is: https://www.surveymonkey.com/r/F29ZGRV

Important Note: Institutions must complete the survey via the link provided above. The attached PDF file is for reference only. Do not use the PDF version to respond to the survey.

Thank you in advance for your assistance. If you have any questions, contact Jessi Spencer Director of OATN Policy, Budget, and Constituent Relations, as 614-728-4706 or jspencer@highered.ohio.gov.

* 1. Demographic Information about the Person Completing this Survey

Name	
Institution	
Department	
Title	
Email	
Phone	

* 2. Please Indicate the Type of Institution that you represent

- ◯ Two-Year Institution
- ◯ Four-Year Institution

2. TMM023- DISCRETE MATHEMATICS

Typical Range: 3-4 Semester Hours

A course in Discrete Mathematics specializes in the application of mathematics for students interested in information technology, computer science, and related fields. This college-level mathematics course introduces students to the logic and mathematical structures required in these fields of interest.

TMM023 Discrete Mathematics introduces mathematical reasoning and several topics from discrete mathematics that underlie, inform, or elucidate the development, study, and practice of related fields. Topics include logic, proof techniques, set theory, functions and relations, counting and probability, elementary number theory, graphs and tree theory, base-n arithmetic, and Boolean algebra.

To qualify for TMM023 (Discrete Mathematics), a course must achieve all the following essential learning outcomes listed in this document (marked with an asterisk). These make up the bulk of a Discrete Mathematics course. Courses that contain only the essential learning outcomes are acceptable from the TMM023 review and approval standpoint. It is up to individual institutions to determine further adaptation of additional course learning outcomes of their choice to support their students' needs. In addition, individual institutions will determine their own level of student engagement and manner of implementation. These guidelines simply seek to foster thinking in this direction.

* 1. Do you agree with Learning Outcome #1.1a?

	Yes- should be essential	Yes- should be non-essential	No
Translate English sentences into propositional logic notation and vice-versa. *(Essential)	○	○	○

* 2. Do you agree with Learning Outcome #1.1b?

	Yes- should be essential	Yes- should be non-essential	No
Construct truth tables for statements involving the following logical connectives: negation, conjunction, disjunction, conditional, and biconditional.* (Essential)	○	○	○

* 3. Do you agree with Learning Outcome #1.1c?

	Yes- should be essential	Yes- should be non-essential	No
Apply De Morgan's Laws to find negations of statements. * (Essential)	○	○	○

* 4. Do you agree with Learning Outcome #1.1d?

	Yes- should be essential	Yes- should be non-essential	No
Define and use these terms: conditional statement, converse, inverse, contrapositive, biconditional, necessary and sufficient conditions, tautology, contingency, and contradiction.* (Essential)	○	○	○

5. Do you agree with Learning Outcome #1.1e?

	Yes- should be essential	Yes- should be non-essential	No
Apply standard logical equivalences to simplify propositions, and be able to prove that two logical expressions are or are not logically equivalent. * (Essential)	○	○	○

6. Do you agree with Learning Outcome #1.1f?

	Yes- should be essential	Yes- should be non-essential	No
Determine if a logical argument is valid or invalid. Apply standard rules of inference including Modus Ponens, Modul Tollens, Generalization, Specialization, Conjunction, Transitivity, and Elimination. Recognize fallacies such as the Converse Error and the Inverse Error. * (Essential)	○	○	○

7. Do you agree with Learning Outcome #1.2a?

	Yes- should be essential	Yes- should be non-essential	No
Translate between English sentences and symbols for universally and existentially quantified statements, including statements with multiple quantifiers. * (Essential)	○	○	○

8. Do you agree with Learning Outcome #1.2b?

	Yes- should be essential	Yes- should be non-essential	No
Write the negation of a quantified statement involving either one or two quantifiers. * (Essential)	○	○	○

9. Do you agree with Learning Outcome #1.2c?

	Yes- should be essential	Yes- should be non-essential	No
Determine if a quantified statement involving either one or two quantifiers is true or false.* (Essential)	○	○	○

10. Do you agree with Learning Outcome #2a?

	Yes- should be essential	Yes- should be non-essential	No
Use the direct proof method to prove propositions.* (Essential)	○	○	○

11. Do you agree with Learning Outcome #2b?

	Yes- should be essential	Yes- should be non-essential	No
Use indirect proofs and proof by cases to prove propositions. * (Essential)	○	○	○

12. Do you agree with Learning Outcome #2c?

	Yes- should be essential	Yes- should be non-essential	No
Identify logical errors and disprove statements. * (Essential)			

13. Do you agree with Learning Outcome #2d?

	Yes- should be essential	Yes- should be non-essential	No		
Use mathematical induction to prove propositions. * (Essential)					

14. Do you agree with Learning Outcome #2e?

	Yes- should be essential	Yes- should be non-essential	No
Utilize other proof methods to prove propositions. * (Essential)			

15. Do you agree with Learning Outcome #3a?

	Yes- should be essential	Yes- should be non-essential	No
Find subsets, unions, intersections, differences, symmetric differences, complements, power sets, and cross products of sets and use them to solve applied problems. * (Essential)			

16. Do you agree with Learning Outcome #3b?

	Yes- should be essential	Yes- should be non-essential	No
Use Venn diagrams to solve problems, illustrate set identities, and apply the inclusion- exclusion principle. * (Essential)			

17. Do you agree with Learning Outcome #4a?

	Yes- should be essential	Yes- should be non-essential	No
Identify basic properties of relations, including reflexive, symmetric, antisymmetric, and transitive properties. Identify equivalence relations, equivalence classes, and partitions. (Non-Essential)	○	○	○

18. Do you agree with Learning Outcome #4b?

	Yes- should be essential	Yes- should be non-essential	No
Find the reflexive closure, symmetric closure, and transitive closure of a relation on a set. (Non-Essential)	○	○	○

19. Do you agree with Learning Outcome #4c?

	Yes- should be essential	Yes- should be non-essential	No
Determine the domain, codomain, and range of discrete functions. Identify injections, surjections, and bijections, and determine which of these characteristics is associated with a given function.* (Essential)	○	○	○

20. Do you agree with Learning Outcome #4d?

	Yes- should be essential	Yes- should be non-essential	No
Demonstrate an understanding of the terms cardinality, finite, infinite, and uncountably infinite, and determine the cardinality of a given set. Use the notion of a bijection to prove that two sets have the same cardinality. (Non-Essential)	○	○	○

21. Do you agree with Learning Outcome #4e?

	Yes- should be essential	Yes- should be non-essential	No
Determine the Big-O estimate for basic functions. * (Essential)	○	○	○

22. Do you agree with Learning Outcome #4f?

	Yes- should be essential	Yes- should be non-essential	No
Define a sequence as a function whose domain is a subset of the integers. Identify arithmetic and geometric sequences, and the factorial sequence. * (Essential)	○	○	○

23. Do you agree with Learning Outcome #4g?

	Yes- should be essential	Yes- should be non-essential	No
Describe how functions, sequences, and sets can be defined recursively. Identify the Fibonacci sequence. * (Essential)	○	○	○

24. Do you agree with Learning Outcome #5a?

	Yes- should be essential	Yes- should be non-essential	No
Solve counting problems involving the multiplication rule and permutations/combinations. (with and without repetition). * (Essential)	○	○	○

25. Do you agree with Learning Outcome #5b?

	Yes- should be essential	Yes- should be non-essential	No
Apply the Addition Rule and the Principle of Inclusion and Exclusion. * (Essential)	○	○	○

26. Do you agree with Learning Outcome #5c?

	Yes- should be essential	Yes- should be non-essential	No
Apply basic principles of discrete probability. (Non-Essential)	○	○	○

27. Do you agree with Learning Outcome #5d?

	Yes- should be essential	Yes- should be non-essential	No
Use Pascal's Triangle to apply the Binominal Theorem. * (Essential)	○	○	○

28. Do you agree with Learning Outcome #5e?

	Yes- should be essential	Yes- should be non-essential	No
Apply the Pigeonhole Principle. (Non-Essential)	○	○	○

29. Do you agree with Learning Outcome #6a?

	Yes- should be essential	Yes- should be non-essential	No
Determine if a proposed statement involving concepts from elementary number theory is true or false. (Non-Essential)	○	○	○

30. Do you agree with Learning Outcome #6b?

	Yes- should be essential	Yes- should be non-essential	No
State and use the Division Algorithm. * (Essential)	○	○	○

31. Do you agree with Learning Outcome #6c?

	Yes- should be essential	Yes- should be non-essential	No
Apply modular Arithmetic. * (Essential)	○	○	○

32. Do you agree with Learning Outcome #6d?

	Yes- should be essential	Yes- should be non-essential	No
State and use the Fundamental Theorem of Arithmetic. (Non-Essential)	○	○	○

33. Do you agree with Learning Outcome #6e?

	Yes- should be essential	Yes- should be non-essential	No
State and use the Euclidean Algorithm. (Non-Essential)	○	○	○

34. Do you agree with Learning Outcome #7a?

	Yes- should be essential	Yes- should be non-essential	No
Identify basic features of graphs, construct graphs with given properties, and represent graphs using matrices or lists. * (Essential)	○	○	○

35. Do you agree with Learning Outcome #7b?

	Yes- should be essential	Yes- should be non-essential	No
Determine whether or not a given graph has an Euler circuit, Euler path, Hamilton circuit, and/or Hamilton path and construct them if so. (Non-Essential)	○	○	○

36. Do you agree with Learning Outcome #7c?

	Yes- should be essential	Yes- should be non-essential	No
Determine whether or not a given graph is planar and apply Euler's formula to planar graphs.* (Essential)	○	○	○

37. Do you agree with Learning Outcome #7d?

	Yes- should be essential	Yes- should be non-essential	No
Identify trees and n-ary trees, create n-ary trees for specified applications including decision trees, and perform tree traversals.* (Essential)	○	○	○

38. Do you agree with Learning Outcome #8a?

	Yes- should be essential	Yes- should be non-essential	No
Preform arithmetic in various base-n systems. * (Essential)	○	○	○

39. Do you agree with Learning Outcome #8b?

	Yes- should be essential	Yes- should be non-essential	No
Convert between various base-n systems. * (Essential)	○	○	○

40. Do you agree with Learning Outcome #8c?

	Yes- should be essential	Yes- should be non-essential	No
Represent signed binary numbers with 1 and 2's complements. * (Esssential)	○	○	○

41. Do you agree with Learning Outcome #9a?

	Yes- should be essential	Yes- should be non-essential	No
Prove and apply properties of the Boolean algebra structure. * (Essential)	○	○	○

42. Do you agree with Learning Outcome #9b?

	Yes- should be essential	Yes- should be non-essential	No
Minimize Boolean algebra expressions and logic networks. (Non-Essential)	○	○	○

43. Comments:

3. Survey Completion

Thank you for completing this survey!